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MEDICAL SERIES 5

THE RELATION OF SIGHT AND HEARING TO EARLY SCHOOL LIFE

BY

GUY L. NOYES

Acting Dean of the Faculty of Medicine and Formerly Professor of Diseases of the Eye and Ear
University of Missouri

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CHAPTER I

INTRODUCTION

The purpose of this bulletin is to present in nontechnical form some of the facts concerning visual and aural disturbances that are related to the early school life. That such relation does exist has long been known but the means of combating and controlling the evil results of the educational process constitute one of the modern problems of preventive medicine.

It is hoped that those who care to know just why a considerable percentage of those who enter school in apparent good health soon manifest impairment of the chief organs of special sense will find a convincing explanation herein. Furthermore it is hoped that teachers and others having the desire to work in this problem of special hygiene may find some helpful suggestions as to the methodical prosecution of inspections of the eyes and ears of school children. No attempt has been made to discuss any of the problems of school hygiene other than those having to do with the functions of sight and hearing.

The very elementary manner in which the refractive errors are described will, it is hoped, be excused by those familiar with physiological optics. The writer has thought best to proceed upon the assumption that the reader possesses no knowledge of optics, and that those desiring deep insight into the problems of physiological optics will naturally seek that elsewhere.

To progress normally in school life and at the same time to retain health, become an active and intimate problem with every child entering school. The incidence of acquired disease of some of the organs of special sense and the process of education are known to bear a constant relation. That the educational process is responsible directly or indirectly for much physical suffering among children cannot be denied. In spite of much intelligent and well directed effort to improve conditions as to the housing and general hygiene of school children, the diseases of early life, and particularly those closely associated with the eyes, continue to show themselves. Moreover the proportion of children afflicted with defective vision increases as the children advance in the grades.

It is plain that a child must gather his education, in school and out, largely as a result of activity of his special senses and especially of the

senses of sight and hearing. The rate of a child's progress in school depends very largely upon the accuracy and rapidity with which he can use his eyes. The requirements of the average school course are such as very promptly to bring into evidence the existence of eye defects. This is for the reason that from the very beginning of school life the eyes are caused to work excessively at the near point, or as is commonly said, for close work, such as reading and writing. The human eye is not naturally and normally adapted for doing sustained close work.

The competition in school for relatively high standing is naturally keen, and is usually stimulated by school officers. As a result, the eyes, whether they be well fitted to stand the strain or not, are made to do work up to the limit of their possibilities, and, as a result, eyestrain promptly develops in a large number of children. With the early recognition of the signs of eyestrain and correction of the defects causing it, a child may continue through the educational process and emerge with both his education and eyesight. Failure to recognize the development of eyestrain and delay in correcting faulty reading habits and eye defects may deprive a child of his higher education, and also take from him for all time a large measure of his useful vision.

In the majority of cases nature prints the danger signs plainly upon the countenance of the child, and if parent and teacher heed the warning, relief is quite certain. The danger signs are many and are often found in organs remote from the eyes. The protean symptoms that we recognize as due to the ordinary use of defective eyes or the excessive use of normal eyes we group under the term Asthenopia, or *eyestrain*. The recognition of eyestrain symptoms and the prompt institution of measures to correct them are the two all important factors in the problem of school hygiene as it concerns the eyes.

To the end that a better understanding may be had of the real nature of eyestrain, there follows an elementary explanation of the functioning of the normal eye as well as a comparative discussion of the abnormal conditions to which it is subject.

The defects of form of the eyeballs which are primarily responsible for the development of eyestrain are known as errors of refraction and are named: farsightedness or hyperopia; nearsightedness or myopia; and astigmatism. Of the three general types of error all have to do with departures from the normal either in shape or size of the eyeball.

CHAPTER II

THE REFRACTION OF THE EYE, ITS ERRORS AND THEIR EFFECT

Normal Refraction.—The refraction of a normal eye is its power of so acting on all the light rays that enter its pupil as to cause them to converge at one point inside the eye and on the retina. Clear and comfortable vision may be had only when all the light rays that enter an eye do con-

verge and meet at a point on the retina. All the powers of the eyes, nervous and muscular, are concentrated on fulfilling this prerequisite for clear vision and as long as the powers are sufficient to accomplish it, as they are within reasonable limits in the normal eye, no trouble arises out of the use of the eyes. As soon as errors of refraction make clear vision difficult or impossible of accomplishment, pain, discomfort and disease are sure to follow, for the eyes still continue to strive after clear vision however difficult or impossible the act may be.

The normal eye is, of course, the standard eye. A normal eye is of such length as to receive all parallel rays of light at a focus upon its retina, while the eye is at rest (See Figure 1). It matters not in which meridian of the front of the normal eyeball the parallel rays enter the pupil, they will all be brought to a focus on the retina by means of the lens system that lies passively within the eye. The eye is said to be at rest when it is not actively focusing. The normal eye focuses for close vision only; for it, no act of focusing is necessary for purposes of clear distance seeing.

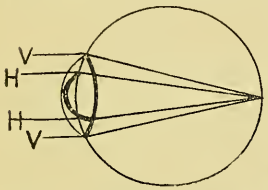

FIG. 1. THE NORMAL EYE. (The letters H and V in this and Figs. 2, 3 and 4 represent rays passing through horizontal and vertical meridians respectively.)

The normal eye is supplied with apparatus by which it can adapt itself for close vision. This apparatus is more or less automatic in its action. The adaptation for close work can be kept up continuously, within reasonable limits, without discomfort or harm to the normal eye. The power of the eyes to adapt themselves or focus for seeing at a varying distance is called *Accommodation*, and eyes in the process of accommodation are said to be accommodating.

The normal eye then is one that is adapted for distance seeing without effort. The normal eye is one that accommodates for close vision only. The distance vision of the normal eye is taken as the standard of vision.

For the purpose of having a clear understanding of the elements of eye refraction it is well to think of an eye as receiving upon its retina the image of every single object at which "it looks". The image on the retina is made by rays of light that proceed from the object looked at through the lens system of the eye, which focuses them on the retina. The image in the eye is plain or indistinct, depending upon the uniformity and accuracy with which the rays meet upon the retina. The entering rays may all meet on the retina, behind the retina, in front of the retina, or part of them may meet in front and part behind the retina. Clear vision results only when all the entering rays finally meet at one point and that point is on the retina. By reason of certain natural laws, all rays of light coming from distant objects enter the eye as parallel rays. Immediately after these parallel rays enter the eye they are gradually bent from their condition of parallelism to a condition of convergence. In the normal eye this bending affects all rays uniformly and is just sufficient in degree to gather them all very accurately at one point or focus on the retina (Figure1).

This outlines the mechanism of all normal distance seeing. It is attended by the expenditure of no muscular energy, or accommodation.

Unlike those coming from distant objects, the rays of light coming from near objects are divergent when they reach the eye. They proceed to and enter the eye as divergent rays. Immediately upon entering the eye, these rays are bent first from their condition of divergence to one of parallelism, and then from parallelism to convergence of just sufficient degree to bring all of them to an accurate focus at one point on the retina. This bending of all the entering rays of light so that they may focus on the retina is the prime function of the transparent inside of the eyeball and is known as its refractive power.

The refractive power of the eye is of two kinds: *passive* and *active*.

The passive refraction is always effective and is never suspended nor augmented. It is not controlled by the will and remains a fixed, unchangeable quantity in a given eye. It is the passive refraction that, in the normal eye, brings all the entering parallel rays of light to a focus on the retina. Likewise it is the passive refraction that acts in the same fixed degree upon divergent rays that enter the eye, tending to make them less divergent. The passive refraction may of itself bring divergent rays to a condition of parallelism or even of convergence, if the rays are not too divergent upon their entrance. In the normal eye the passive refraction is never sufficient finally to bring divergent entering rays to a considerable enough convergence to cause them to meet at a point on the retina. In other words, the passive refraction cannot of itself give clear close vision to the normal eye. To do that more ray-bending power is needed than that which the passive refraction can supply. When the passive refraction has accomplished all that it can, then the active refraction is promptly and automatically brought into play in just sufficient degree in the normal eye to bring all the entering rays of light together at one point on the retina.

The active refraction is unlike the passive refraction in that the former is changeable and is used in varying degrees sufficient always to enable the eye to see clearly that close object at which it looks. The active refraction is never used by the normal eye save for purposes of close vision. In some abnormal conditions of refraction the active refraction is made use for distance seeing. Whenever for any reason the passive refraction is insufficient, the active refraction may be made use of to accomplish the perfect focusing. Such is the case in farsightedness.

The active refraction of the eye is its power of accommodation, and the process through which it is accomplished is known as the accommodation of the eye. The accommodation of the eye is its power to adapt itself for distinct seeing at varying distances. The accommodation may be brought truly under the control of one's will, but it acts, as a rule, with the greatest accuracy in a purely automatic way. The accommodation is made use of in widely varying degrees. It is used in increasing degree as the objects at which one looks approach the eye. The effort to see becomes progressively greater the nearer the object at which we look

approaches the eye. At such continuous tasks as reading, writing, sewing, etc., the accommodation is used at its maximum.

To recapitulate then, the normal eye sees all distant objects clearly without accommodation. This it does because all distant objects send parallel rays of light to the eye and the passive refraction of the normal eye is sufficient to bring all parallel rays together at a focus on the retina. In other words, the normal eye is in a condition, when at rest, to receive parallel rays of light at a focus on its retina. The normal eye sees close objects clearly by the use of its accommodation or active refraction. All near objects send divergent rays of light to the eye and the passive refraction cannot possibly bend them to a sufficient degree of convergence to make them meet on the retina. If only the passive refraction were used they would gather at a point behind the retina. This would not fulfill the necessary conditions for the production of clear vision. Here the accommodation is brought into use. It exerts itself upon the insufficiently convergent rays and makes them all convergent enough to meet at a point on the retina. The conditions necessary for clear vision have been supplied by the accommodation and the eye "sees" the close object clearly. The accommodation power is made use of by the normal eye in all such acts as reading, writing, sewing, etc., etc. It is a perfectly normal process when used simply for purposes of close vision by the normal eye.

Farsightedness.—The farsighted eye is shorter than the normal eye. It is so short that the point of focusing of parallel rays is always behind the retina while the eye is at rest (see Figure 2). The farsighted eye accommodates both for distance vision and near vision. The farsighted eye then is not adapted for seeing at any distance far or near, without effort of accommodation. The farsighted eye is supplied with the same kind of automatic focusing apparatus as the normal eye.

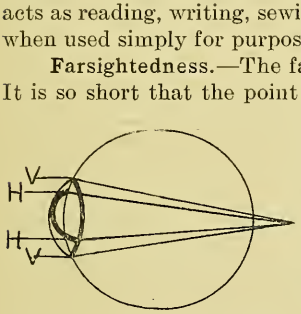

FIG. 2. THE FARSIGHTED EYE.

Unlike the normal eye the short one makes use of some of its focusing power (accommodation) for distant seeing. This is abnormal and in the economy of nature no adequate provision has been made for such demands as are thus thrown upon the muscles of accommodation. Normally this power is held in reserve for purposes of close vision. The accommodation has certain very definite limitations in range or power and since the short eye uses some of its accommodation for distance seeing, it has just that much less in reserve for purposes of reading. Reading or any close work then is accomplished by the highly farsighted eye under the greatest of difficulties. The reserve power of the eyes is soon exhausted and fatigue and eyestrain follow. The distance vision in the farsighted eye is good except in conditions of very high farsightedness. Twenty per cent of all eyes coming under test are farsighted.

Farsightedness may be corrected by the use of glasses. The defect in form is not overcome or cured by the use of glasses. Proper glasses

neutralize the defect in form as long as they are worn. The purpose of correcting glasses in hyperopia is to create a normal condition of refraction for distance seeing. To do this the correcting lens must be just strong enough to act upon entering (parallel) rays of light in sufficient degree to allow them to focus on the retina of the hyperopic eye when it is at rest, i. e. using only its passive refraction. By this means glasses overcome the symptoms of eyestrain produced by farsightedness.

In the majority of farsighted persons glasses do not improve the distance vision, in fact blurring of distant objects is common when glasses are first worn to correct farsightedness. Such blurring soon disappears when the proper glasses are worn continuously.

A plus spherical, or magnifying, lens is used to correct simple hyperopia. The glasses are prescribed in the case of farsightedness not necessarily to make one see better but to make him see comfortably. Glasses are necessary, not because the patient has farsightedness but because his farsightedness is making eye strain that must be cured. Glasses used for the correction of eye strain dependent upon farsightedness may be worn all the time or only for close work. They should be worn enough to cause all symptoms of eye strain to subside. It sometimes happens that a school child may properly discontinue the use of glasses after having worn them a year or more.

In the early years of life farsightedness shows a tendency to decrease. This tendency may be marked enough so that in the first few years of school life eyes previously farsighted may gradually become nearsighted.

Nearsightedness.—Myopia or nearsightedness is that condition of abnormal shape or form in which the eyeball is too long. In this respect the condition is the exact opposite of farsightedness.

The nearsighted eye in the majority of instances is a diseased eye and unless precautionary measures are adopted early in life, the nearsighted eye will automatically become more and more nearsighted and more diseased until finally at midlife a large portion of the acute seeing power will be gone beyond recall.

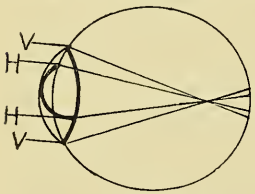

FIG. 3. THE NEARSIGHTED EYE.

The nearsighted eye is one that, while at rest, receives parallel rays of light at a focus in front of its retina. (Figure 3). It follows therefore, that since parallel rays come to the eyes from distant objects, the nearsighted eye sees nothing clearly in the distance. Nor can it by use of its accommodation adapt itself for clear distance seeing.

The nearsighted eye is one that is in condition to receive divergent rays at a focus on its retina. Divergent rays, as we have seen, do exist in nature and are emitted from all objects that happen to be situated less than twenty feet from us. The myopic eye is in a condition then to see some close objects clearly without effort of accommodation.

Unfortunately there exists no power within the nearsighted eye that enables it to correct automatically its faulty refraction. The use of the

accommodation could never under any condition improve the distance vision of a myopic eye. As children ascend through the school grades the proportion of myopia to other defects gradually increases. In the very beginning of school life about two per cent of children have myopia while of those of late high school or early college life thirty per cent have myopia. Moreover nearsightedness by its very nature provides for its own increase and when untreated and uncorrected by glasses, its tendency is to increase constantly in degree. Progressive increase in degree of nearsightedness means constantly increasing elongation of the eyeball. Elongation becomes so great that the delicately organized tissues of the inside of the eyeball can no longer adapt themselves to the stretching process and they are finally ruptured, with very disastrous results to vision.

Early and proper correction of myopia by glasses will usually stop its further progress. The correcting glass in myopia must so act upon all rays of light that enter the eye as to delay their focusing until they have passed through the long eyeball and reached the retina. A minus spherical or minifying glass corrects myopia.

Correcting glasses are prescribed in myopia to give clear and comfortable vision. No rule may be given for the use of glasses in myopia. Some myopes need glasses all the time and some use them only for distance seeing. Nearsightedness is usually associated with more or less astigmatism.

The accommodative function of the eye, so useful in the automatic neutralization of farsightedness, so far as excessive use is concerned, plays no part in the eyestrain associated with nearsightedness. In myopia, however, the discomfort of eyestrain may be as considerable as in hyperopia and the involvement of the seeing power is even greater. The eyestrain symptoms in nearsightedness may be in the main the same as those accompanying farsightedness. The distance vision is always lowered in myopia. Nearsightedness should be considered as a disease and sufferers from neglected nearsightedness must confidently expect to lose more or less of the usefulness of their eyes as time passes. The permanent loss of vision in myopia is as a rule commensurate with the amount of nearsightedness.

While the distance vision in nearsightedness is always lower than normal it can be brought up to normal by proper correcting glasses, if no disease exists in the eye.

Astigmatism.—The third of the changes in the shape of the eyeball which are classed as refractive errors is astigmatism. Of all eyes subjected to careful examination sixty-five per cent have some form of astigmatism. This does not include that small and inconsequential astigmatism that we call normal because it exists in all eyes. The normal astigmatism is that which makes stars in the sky appear to have an irregular outline. Normal astigmatism does not give rise to eyestrain.

In astigmatism the defect is not one necessarily involving length of the eyeball. Normally all light rays entering the eye are bent to a com-

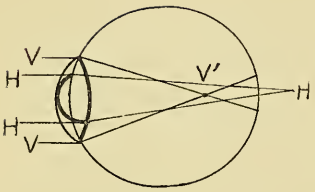

FIG. 4. THE ASTIGMATIC EYE.

mon focus on the retina. This bending process is begun by the cornea which normally bends all the light rays that pass through it in equal degree. In astigmatism the cornea bends all the rays but does not bend them equally, and as a result the rays that pass through one meridian are brought to a focus before those passing through other meridians. It happens that as a rule the rays passing through the vertical corneal meridian of an astigmatic eye come to a focus before those passing through the horizontal corneal meridian. Such a condition of astigmatism is shown in Figure 4.

The defect in astigmatism lies in the cornea or in the lens, more often the former, sometimes in both. The nature of the defect is a change in the curvature or in the refractive index of either the cornea or lens. Instead of being evenly curved in all meridians like an ordinary sphere, the surfaces of the cornea or lens partake in small degree of the shape of the side of an egg, i. e., curved more in one meridian than all the others. This unequal curvature of the surfaces through which light rays must pass to reach the retina makes an accurate focusing of the rays impossible and consequently makes clear and distinct vision impossible. No power lies within the astigmatic eye automatically to correct such faulty focusing. The exercise of the accommodation can give no clearer vision to the astigmatic eye, for the accommodation affects all rays in equal degree. The astigmatic eye continues to strive for clear vision however, and this continual strife for the unattainable creates eyestrain of the very worst and most aggravated type. Sufferers from astigmatism may have all the most acutely painful and generally disturbing symptoms of eyestrain.

Astigmatism is usually found to be present in combination with either nearsightedness or farsightedness. The most common error of refraction is that in which astigmatism and hyperopia are combined. That this is unfortunate is plain when one considers that all the disturbing symptoms of astigmatism are, under such conditions, simply superimposed upon those of hyperopia.

No symptom is necessarily characteristic of astigmatism, but it does usually greatly intensify the symptoms of eyestrain. It is astigmatism as a rule, and sometimes only the very smallest degree of it, that creates the reflex nervous symptoms of eyestrain. Such are the symptoms of eyestrain that are found in regions remote from the eyes and at first sight having no apparent relation to the eye. The limits of the body alone limit the remoteness at which reflex symptoms of eyestrain may develop when caused by astigmatism.

Like myopia and hyperopia, astigmatism may be corrected by glasses. The lens which will correct this refractive error is known as a cylindrical lens. Its action may be either magnifying or minifying. It is peculiar

in that it refracts rays of light in all of its meridians save one. Rays of light that pass through the axis of a cylindrical lens are not refracted at all. A little thought and reference to Figure 4 will show the usefulness of cylindrical lenses in the correction of astigmatism.

Eyestrain.—Under the term "eyestrain" we assemble that group of unnatural symptoms and signs that follow the use of the eyes for close work. The evidences of eyestrain may develop in those who have no real defect in form of the eyes. Under such conditions the eyestrain is caused by the faulty use of a relatively normal organ. Eyestrain is usually due to some defect of form, i. e., some refractive error. Technically, eye strain is spoken of as *Asthenopia*, which means weak eyes. It is well to keep in mind that weak, in this connection, means lacking in strength. There is a popular belief that a weak eye is a tearing eye, but such need not necessarily be the case. Tearing may be the result of conditions having absolutely nothing to do with eyestrain or the act of seeing.

There are three general groups of eyestrain symptoms referable to the eyes themselves.

1. Accommodative.—

This group is due to abnormal demands upon the focusing muscle of the eye. This type is no doubt most commonly associated with hyperopia.

2. Muscular.—

This group is due to imbalance in the relative strength of the muscles that move the eyeballs in their sockets. Asthenopia of this form may result from one kind of refractive error as well as another.

3. Nervous and Retinal.—

This group is due to unusual irritability and sensitiveness of the retina or nervous coat of the eye. Astigmatism, more than the other errors of refraction, is responsible for this form of asthenopia.

All types of asthenopia are due primarily to some abnormality in the refraction of the eyes. Eyestrain shows itself by certain quite constant signs and symptoms. With experience in the observation of such conditions we soon come to look upon certain groups of signs and symptoms as positive evidence of eyestrain and upon other groups as presumptive evidence. Indeed there are those evidences of eyestrain that, existing alone, might be classified as doubtful, but when found in combination with positive signs become themselves of positive significance. There are a large number of eyestrain symptoms the manifestations of which are anatomically more or less remote from the eyes. Such symptoms are often so distressing as to make a condition of practical invalidism. Except to the skilled observer, the symptoms in this group may not attract attention, as a part of a condition of or the result of eyestrain, because of their very remote location in the body in relation to the eyes. A persistent pain in the back of the neck for instance, or indeed a condition of serious indigestion or lateral curvature of the spine may be due solely or primarily

to eyestrain. One such symptom should not be looked upon as sufficient to make certain the diagnosis of eyestrain. With intelligent questioning it is almost always easy to elicit from the sufferer from eyestrain the fact of the existence of many positive symptoms. The conclusive and usually easily determined fact is that the group of symptoms indicating eyestrain usually develops after the use of the eyes in reading, writing, and other acts requiring the use of the eyes at arm's length. It is true that eyestrain may be in evidence without relation to the use of the eyes for close work. The symptoms may bear a constant relation to the use of one's eyes during his waking hours.

Certain eystrain sufferers find their symptoms to be associated with theatre going or attendance in other brightly lighted places. A long drive or a ride in a railroad train may also precipitate an attack of eyestrain. In the latter case one is said to be car-sick. People have been known to suffer for years from car-sickness only to find by accident that correction of hyperopia or astigmatism by glasses caused the car-sickness to disappear altogether.

There follows a list of the common signs and symptoms of eyestrain.

Rapid fatigue of eyes during reading, writing, etc; headache; sick headache; pain in the eyes; blurring of print; feeling of sand in eyes; pain in the back of the neck and between shoulders; difficulty in fixing attention or concentrating one's mind on reading matter; tendency to rub and press on the eyeballs; redness of the edges of the lids; accumulation of branlike masses on the edges of the lids; double vision; dread of light; dizziness; cross eye; nausea; floating spots before eyes; tearing; car-sickness; blindness in one eye; various neuralgias; brain fag; drowsiness; twitching of the lids; a tendency to the development of stys in "crops"; many serious, destructive, and inflammatory conditions affecting all of the tissues of the eyeball.

Some of the remote reflex nervous evidences of eyestrain are, serious disturbances of the digestive tract, and even of the brain and spinal cord. They may lead to St. Vitus's dance, epilepsy, lateral spinal curvature, nervous breakdown, criminality and truancy.

It should be remembered that no absolutely constant relation exists between the degree of eye defect and the intensity of eyestrain symptoms. Relatively small defects may cause most severe symptoms, and large errors may pass for years unnoticed. Conditions of general ill health bring eyestrain symptoms into prominence and so does constant close work. The person who does no reading or writing or other close work is not apt to show the symptoms of eyestrain even if his eyes are defectively formed. The symptoms of eyestrain seldom result from use of the normal eye. They do come quickly from the ordinary use of the defectively formed eye. The defect may be ever so small and yet the resulting symptoms may be overwhelming. On the other hand, it is true that the diseased processes almost constantly associated with nearsightedness may progress to the point of destroying a large measure of sight without a single painful symptom.

The best way to conserve the eyesight and prevent the diseases associated with eyestrain is to correct, especially in early school life, all errors in the formation of the eyes by means of glasses. Nothing short of the most skilful examination and most careful and accurate adjustment of glasses is adequate to meet the conditions that actually exist in a case of ordinary eyestrain. The present day demands upon the eyes, so far as the educational process is concerned, are entirely in excess of the normal latent and inherent ability of the eyes to perform. The average eye is not so constructed as naturally to adapt it to the doing of close work for long periods of time. As a necessary consequence, the symptoms of faulty function, or eyestrain, are commonly in evidence soon after the beginning of school life. Since the eyes are not equal to the work that they are called upon to do, no surprise ought to exist as to the increasing need for glasses and their use. The only means by which the insufficiently adapted organ may be artificially adapted to do that which is required of it without damage and disease is by the use of spectacle lenses.

The act of distance seeing should be an absolutely passive process and, after the eyes have once been directed toward an object, seeing should be carried out with as little expenditure of bodily energy as the process by which the ear perceives ordinary sounds or that by which the forms of objects are communicated by the sense of touch. This ideal condition exists in the normal eye. It does not and cannot exist in eyes with refractive errors. In such eyes all clear and distinct distance seeing is accomplished only by a positive muscular and nervous effort, unconscious though it may be. Since no adequate provision is made by nature for this extraordinary effort the symptoms of fatigue soon appear. The act of close seeing as in reading, writing, etc., makes even greater demands upon the muscular and nervous energies.

The Effects of Eyestrain and Refractive Errors Upon Character.—That farsightedness, nearsightedness, and astigmatism do influence one's habits of life in characteristic ways is certain.

Aside from the primary evidences of mere eyestrain common to all the types of refractive error, there soon shows itself, in some pupils, a certain habit of mind that we associate with nearsightedness. It should be recalled that the zone of perfect vision in nearsightedness is always less extensive than in the normal condition of sight. With an increasing degree of nearsightedness the zone becomes more and more restricted until, in what might be called a moderate degree of nearsightedness, a child may see nothing clearly and distinctly beyond the length of his arm. Having had no experience with normal seeing the child with poor vision assumes that he sees as well as others, indeed, he often insists that he can see very well and as well as his companions and schoolmates. As a matter of fact he sees well and with distinctness to the minutest degree of detail the things within his limited zone of vision. He has never seen trees in blossom or in full leaf as the normal child does. His zone of distinct vision has been restricted until he can touch with his forefinger, as it were, any point in the whole circumference of his own visible horizon.

It falls to the lot of every oculist to witness the expressed joy of the nearsighted child of grade school age who, after having been given his first pair of glasses, sees clearly across the street, and, for the first time in his life, gets a glimpse of distant scenery with its hills, dales, trees and homes which have been to him previously unknown, in the composite visual sense.

By reason of this very restricted zone of vision a nearsighted school child without glasses gradually loses interest in games and sports that require good distance seeing. His interests are confined to such things as can be clearly seen by him. He develops easily the studious habit and becomes a leader in his classes. His success as a student brings forth the encouragement and approbation of his teachers and elders. This he naturally enjoys and in the stress of competition he clings to the work that he does successfully and abandons entirely the normal out of door sports and life.

A tardy school inspection, the serious disease of his eyes,—*directly due to his excessive study*, or a mere accident, may be the cause of his first information concerning the real condition of his eyes. At ten or twelve years the information may have come too late. All the terrible ruin of progressive nearsightedness may have consumed the delicate retinal elements in sufficient degree to have destroyed a measure of vision beyond all hope of cure or neutralization by glasses. All this may have come about without a single painful symptom. The inflammatory disease of the vital, vision giving structures of the eyes is the direct result of nearsightedness, sooner or later, in seventy-five per cent of all eyes affected by nearsightedness.

Destructive and progressive nearsightedness is a natural concomitant of school life and of the life of the essential eye user. Nearsightedness increases and its complications develop in early school life in spite of the most intelligent attention to the general principles of school hygiene as to school architecture, furnishings, light, ventilation, etc. The only means by which this ruinous condition may be controlled in any degree are by correcting promptly with glasses any error of a nearsighted nature and restricting the amount of close work to be done. Unlike the other refractive errors, nearsightedness by its very nature provides for its own increase, and the only way to arrest the progress of the defect is by prompt change and adjustment in the correcting glasses in accordance with the advice of an oculist. The proper management of the nearsighted child in school, so far as the eyes are concerned, calls for all of the intelligence and skill of the most accomplished oculist. The early discovery and correction of nearsightedness then will tend to check its further development. Early correction of nearsightedness restores normal distance vision and allows a child the opportunity for development of all those out of door interests which we look upon as normal in a child and which are automatically withheld from the child with uncorrected nearsightedness.

So far as the influence upon the general intellectual development is concerned, farsightedness and astigmatism may be considered as one con-

dition. As a matter of fact the combined errors of farsightedness and astigmatism furnish by far the most common type of refractive error. When the farsightedness predominates and the astigmatism exists in small degree the distance vision may be very good. Conditions of farsightedness and astigmatism work their untoward influence upon the development of character not by reason of lowering the vision but because of the discomfort that they cause during the use of the eyes. Small degrees of astigmatism always lessen in some degree the acuity of vision, though not by any means to the same degree as nearsightedness. As has been mentioned previously, clear and distinct vision either for distant or near points is obtainable by the farsighted eye only by the expenditure of a definite but unconscious muscular effort. This effort is not required of the normal eye and no adequate muscular or nervous provision has been made by nature to furnish this excess of energy for the farsighted eye. The farsighted and astigmatic eye works under an overload during all of of one's waking hours. Persistence in close work under such conditions results in an overdraft on the visual apparatus and the consequent development of eyestrain and its train of discomforts and lessened ocular efficiency.

In the case of a child in early school life it is plain then that, if he suffers from any considerable amount of farsightedness or astigmatism, no pleasurable reaction can come from efforts to study. His power of mental concentration is soon overcome, dominated and submerged as it were, by intensely disagreeable sensations the source of which he in his inexperience cannot locate. He has blurring perhaps, but cannot describe it or does not realize that he sees less distinctly than other children. He does soon learn to associate intimately his school tasks requiring the use of his eyes with certain very uncomfortable sensations such perhaps as headache, eyeache, backache, mental confusion, drowsiness, nausea, dizziness, double vision, etc. He recognizes that he is relatively comfortable before and after school, and he naturally associates his pleasurable sensations with out of door activities. The gaining of knowledge by means of his visual organs in school provokes only painful sensations and he shuns study. He is interested in sports and shows normal or maybe more than normal prowess, both physical and mental, in the activities that do not require the use of the eyes for close work. In the competition of the school room for grades, he falls behind his fellows and finds himself discredited at home and in school. The unhappy child may have very acute vision and be unable to associate cause and effect in his difficulty. He cannot whip his eyes into submission, they dominate and call him away from eye work to the restful open out of doors. The road to truancy is short and easy from this point.

Many such a farsighted pupil of tender years is unfairly adjudged vicious and is chastised at school and at home. Whether the chastisement take the form of physical or mental degradation, the net result is the same. The child learns to hate the school, its methods, and all those who personify it. The remedy is clear to see and easy of accomplishment.

Teachers in public schools should be so trained that they may quickly recognize the early signs of eyestrain as shown in otherwise apparently healthy and vigorous youngsters. To the everlasting credit of the teaching profession let it be said that teachers are intelligently alert to this problem as a rule and that parents stand in the way of the correct management of the problems of ocular school hygiene far more frequently than do teachers.

Rigid, repeated eye inspections in the schools will surely save the eyestrain sufferer from the sorrows which he innocently bears. The correct determination of the kind and amount of refractive error and its accurate correction by means of glasses will prevent blindness, suffering and failure in early school life which is the portion of a pitifully large percentage of those who enter school. Moreover, it appears plain that if certain children begin the educational process with eyes essentially unfitted for close work of long duration and, furthermore, if the educational process itself tends to increase this ocular disablement, our duty is to advise the pupil against a career of such nature as to demand the excessive use of the eyes. Preparation for the practice of all the professions contemplates really excessive use of the eyes. Insistence upon a greatly modified curriculum and lengthening the number of years of school life furnish the only means, in addition to skillful correction of defects, of making it at all safe for the nearsighted child to attempt to prepare himself for a career as an essential eye user.

CHAPTER III

TROUBLES OF HEARING

The eye troubles just considered may fairly be looked upon as being caused in large degree by the educational process itself. This of course does not apply to diseased throat and ear conditions except as they are favored by faultily constructed and managed school houses. It so happens that the years of childhood are those in which the common ear and throat conditions here considered frequently occur. It follows then that throat and ear diseases and their complications are responsible for a large part of the absences from school of young children.

Of all the organs of special sense, the ears are the ones most neglected even after their function has become notably impaired. Repeated recurring attacks of ear trouble with great pain and discharge (risings) are looked upon by many parents as unavoidable misfortunes to be dreaded but not to be considered as serious even so far as the function of hearing is concerned. The condition of chronic discharging ear is the cause of forty per cent of all cases of abscess of the brain.

It is well to remember that a "running ear" acquired possibly by neglect during childhood will prevent its possessor from obtaining first class life insurance in adult life. As a matter of fact every single attack of middle ear inflammation (earache) leaves its mark upon the ear tissues and

reduces in greater or less degree the power of hearing. The condition ordinarily spoken of as earache, whether followed by discharge from the ear canal or not, is due usually to the presence of adenoids either enlarged or diseased. Earache should be looked upon as one of the symptoms of a very serious ear disease, serious always as to its effect upon the hearing and sometimes even serious as to life itself. A running ear should always be treated by an ear doctor; it will not get well without good care. Children do not "outgrow" running ears.

It so happens that few, if any, organs in the human body can fall so far below the normal in the performance of their function as the ears, without the defect being noted. The sum total of normal hearing is much in excess of that actually necessary for daily contact in school. An unnoticed deficiency in hearing may even include the total loss of hearing of one ear. Practically all the ear troubles noted in early school life may be controlled and recurrent attacks may be prevented by prompt attention at the hands of an aurist. When deafness is so marked as to be detected easily by the unskilled observer, the opportunity to do the greatest good by treatment has gone. Repeated examinations, two or three in each school year, are necessary if the greatest good is to be achieved.

Faulty habits of cleansing the ear canal may lead to disease of the ear. A moist cloth applied on the finger is the only object that one should put in his ear for the purpose of cleansing it. The custom of using earspoons, hair pins, pens and other metallic objects in efforts to dislodge wax from the ear is a very dangerous one and has led to very serious consequences. If the ears need cleaning further than can be accomplished by the means indicated above, a doctor should advise it or carry it out himself. A considerable quantity of loose wax is normally found in the ear canal and does no harm there.

Children known to have chronic discharging ears should not be allowed to "dive" while bathing. Vigorous blowing of the nose to the point of making the ears "pop" is dangerous. Children should be taught to blow the nose in the loosely held handkerchief without pressing one side of the nose. Much ear trouble may be avoided by so doing.

Adenoids in their Relation to Hearing.—With the exception of eye-strain, the most important common affliction of school children is nasal obstruction. The nasal obstruction due primarily to swelling of the structures within the nose itself is not common except in the case of ordinary "cold in the head". The nasal obstruction due to enlargement of the pharyngeal adenoid, a structure in the very back part of the nasal cavity, is common and very disastrous if allowed to continue. Mouth breathing and all its direct consequences are promptly evident results of enlarged adenoids. Ear symptoms also are very prominent.

The word "adenoid" has come generally to mean that mass of tissue lying normally in the very uppermost part of the throat where that cavity communicates with the back part of the cavity of the nose. It is in this sense that the word is used here. The ear and throat troubles of children

of school age are for the most part due to the presence of abnormal tonsilar or adenoid tissue, one or both. The adenoid and tonsils are normal tissues and are found in every individual. These tissues depart from the normal in three ways: They may be diseased or they may be enlarged or they may be both diseased and enlarged.

Disease may be present in great degree without much apparent enlargement. There is a well recognized condition in which the tonsil is much enlarged but hidden from view as the throat is ordinarily seen by simple inspection. The judgment of the average individual as to the size of the tonsil or as to the extent of disease in a tonsil is quite worthless and such judgments to be of value must be made by the physician. The usual *external* evidences of enlarged tonsils and adenoids are so characteristic that no skilled observation is required to determine their presence.

The usual signs and symptoms of either enlarged tonsils or adenoids or both together are: mouth breathing with snoring or very loud breathing during sleep; the mouth breathing soon causes a characteristically fixed and expressionless countenance; the child appears of low mental caliber, takes cold easily, and has "snuffles" almost continuously. Earache is common.

The bony framework of the face undergoes abnormal changes such as retraction of the lower jaw and narrowing of the dental arch. The whole mental and physical development of a child may be heavily handicapped by this condition to the degree often of making a child of distinctly low mentality and of causing every appearance of critical arrest of development with poor nutrition. Disregard of the signs of nasal obstruction in early life may not only fix for all time the unfortunate abnormalities of face and frame, but may also make way for a train of abnormal conditions known generally as rheumatism and heart trouble. Indeed severe attacks of tonsilitis are often followed by Bright's disease, inflammation of the joints, and of the lining and covering of the heart.

The probability of occurrence of all these unfortunate things can be entirely overcome by giving proper consideration and attention to the early signs of enlarged adenoids and tonsils. Certain and complete relief lies in early operation for removal of the obstruction. By early operation is meant operation as soon as symptoms of obstruction or disease develop.

From six to twenty-five per cent of school children have nasal obstruction in some degree. The wide margin between the six and twenty-five per cent is accounted for by the fact that the children of the poor are more apt to be affected than others. Increasing age and life under favorable conditions seem to lessen the occurrence of nasal obstruction.

For the purpose of giving a better understanding of the symptoms arising out of enlarged and diseased adenoid tissue, it is well to classify some if not all of them in three general groups as follows:

A. Obstructive symptoms:—Mouth breathing, periodic embarrassment in breathing and swallowing, noisy breathing (snoring) at night, "throaty" speech with strong nasal quality.

B. Catarrhal Symptoms:—Continuously recurring colds in the head, cough, asthma, and sore throat.

C. Complicating Symptoms:—Imperfect facial development; irregularity in eruption of the teeth; abnormal formation of the jaw bones; enlarged glands in the neck; fever; general nervous irritability; malnutrition as evidenced by pallor, emaciation, and skeletal deformity of chest; earache; deafness; acquired deaf-mutism; endocarditis (inflammation of the heart); arthritis (inflammation of the joints); twitching or spasm in the muscles of the face; mental dullness; tendency to "catch" infectious diseases easily.

The symptoms here mentioned are not all that may be caused by nasal obstruction. Of course the mere schoolroom life is not directly responsible for the development of nasal obstruction except in so far as poorly ventilated rooms predispose to adenoid enlargement. One noted hygienist is quoted as having said recently that enlarged adenoids could be cured by a continued residence in the open air. This statement should not be considered as meaning that any one recommends such a procedure in the presence of symptoms as pronounced as those mentioned above.

It so happens that all the acute infectious fevers and diseases of children characterized by fever and skin eruptions have a tendency to cause an increase in the size of all adenoid masses. Since children in early school life are particularly susceptible to the group of infectious fevers typified by measles, chicken pox, etc., it follows naturally that at about the ordinary age of early school life there is a tendency toward enlargement of adenoid tissues. It seems impossible that such prominent signs of disease as those here tabulated should escape notice in the homes of children. That they do escape notice or are disregarded is common knowledge.

The school inspection with its card of warning and recommendation is very helpful to many timid parents as a moral bolster. All the pressure and influence of the school organization should be brought to bear to induce parents to seek medical advice and attention in the event of the discovery of nasal obstruction or its complications. Finally the physician must determine whether symptoms referable to the nose and throat are due to enlargement of the pharyngeal adenoid or of the tonsils or of both. With enlarged tonsils the adenoid will always be found enlarged but enlargement of the adenoid may occur alone without abnormality in the tonsils.

Mouth breathing once established may persist as a habit after the most thorough removal of the nasal obstruction.

Tonsils and adenoids may safely be removed at any time of the year. The tendency to "take cold" is lessened rather than increased by operations for removal of obstructions in the nose and throat.

CHAPTER IV

SCHOOL HYGIENE

The age at which a child should go to school should be determined by his physical as well as by his mental condition. The child who shows any tendency toward nearsightedness or other eye defects should be protected against the regular educational process until repeated tests of his eyes show the defects to be under control and stationary. Attention to this detail will in the end assure to a child the utmost of success and celerity in the completion of his preparation for his life work.

The investigation of Risley, Standish, Allport and others have enabled us to formulate certain fundamental rules concerning the building and lighting of school houses and the printing of schoolbooks. Briefly they are as follows:

Window-space should be at least one square foot to every five of floor space.

The nearest building should be twice as far away as its height.

Light should fall on pupils' desks from the left and rear.

No light should fall or be reflected directly into pupils' faces.

No artificial light should be required in the ideal school room.

North light is preferable but a proper arrangement of awnings and shades makes light from any direction available.

School rooms to conform to the ideal should have the following dimensions:

Length	32 feet
Width	24 feet
Height	15 feet
Window space (linear measurement)	24 feet
Height of window sills from floor	3 feet
Height of windows	11 feet

Such a room will accommodate forty-five pupils.

All school furniture should be so arranged as to allow of ready adaptation to the size of the individual pupil to the end that the normal erect sitting posture may be readily maintained.

School books should be easily read and be light enough to be held easily in one hand.

The type from which they are printed should not be smaller than ten point or long primer.

The printed lines should be not more than four and one-half inches long.

The lines should contain not more than sixty letters and should be at least one-tenth of an inch apart.

The paper should be free from glazing so that no shine is apparent on its surface.

The playthings of kindergarten and primary schools should be large and never have on their surface small characters or figures at which young and tender eyes will be caused to look intently and continuously.

Blackboards should never be situated between windows. They should invariably be of a dull black and not shiny. Characters written on them should be in a strongly contrasting color and in size sufficient to be seen easily by all pupils in a school room.

One should never read in a dim light. Bright direct sunlight should be excluded from the eyes while reading.

The best possible form of reading light is diffuse daylight, and artificial light that resembles that most closely is to be desired.

Of the three agents for producing artificial light,—electricity, gas, and kerosene, the latter probably makes the best light when proper burners, lamps, and care can be provided. The inconvenience and odor and the difficulty in properly attending oil lamps makes their use impractical as a rule. Moreover they do produce too much heat and vitiate the air in the rooms in which they burn. Gas, when used with an incandescent mantle, produces a good white light but it develops too much heat and also vitiates the air in which it burns. All things considered electricity furnishes the best light when properly supplied. It can be supplied in steady volume uninfluenced by currents of air. It supplies the maximum of light with the minimum of heat. The naked loop of the electric bulb has properties that impair its usefulness as a reading light. All bulbs used for reading should be wholly or partly frosted.

Eye work carried out under direct and semidirect systems of artificial illumination is attended by a rapid fall in ocular efficiency. The ideal system of artificial illumination is the indirect method by which no light falls directly upon the work but all of it is reflected from the walls and ceiling. Proper indirect artificial illumination is best obtained by electricity. Professor Farree has shown that in doing continuous work by means of indirect illumination the loss of ocular efficiency is not much greater than with the use of diffuse daylight.

Any hanging light that swings is unfit for use in reading. The arc light, however modified, is unfit for purposes of reading.

Children who read or otherwise use their eyes in school in great degree should not read at home during the school term. Body position, source of light, and degree of light are as apt to be disregarded at home as in the school room. Children should not read in any other than the erect sitting posture. Greek characters, German script, and the music staff and notes are particularly trying to the eyes of those who have astigmatism. Music, Greek, and German should never be combined in the curriculum of one who suffers from eyestrain. The eyes should be rested at frequent intervals while reading. The best plan is to shift from one occupation to another for short periods of time.

Printing that cannot be seen at twenty inches should not be read continuously at any distance.

To read when one is drowsy is dangerous.

Effort at reading through poorly adjusted glasses is damaging to the eyes. Reference is made here not so much to poorly adapted glass lenses as to ill-fitting frames.

The use of unclean lenses is unwise.

In the case of a child it is a good general rule to assume that if he needs glasses at all he needs them all the time and should be caused to wear them continuously.

"Why do so many people, especially children, wear glasses now-a-days"? The above question one hears frequently and the answer is simple. It is only within relatively recent years that we have come to recognize the relation between the eyes and that group of symptoms that we know means eyestrain. That the eyes of the human family are being destroyed is not true. That our remote forefathers had better eyes and sight than we have is probably not true. That they had less trouble with their eyes may be true but such was the case simply because they used their eyes for reading much less than we do now. Fifty years ago relatively few children continued long in school and those who did strive for higher education and achieve it, in spite of severe eyestrain, had no means of knowing that glasses would relieve their discomforts.

The condition that we know as appendicitis is not new and probably is no more common than it used to be, although our present day habits of life may tend to induce it. Doctors now know appendicitis when they see it, they know what to do for it to save life, and consequently operation for its cure is common. Eyestrain has existed ever since man began to study and so our present day habits of study tend to induce eyestrain. Doctors now-a-days recognize eyestrain by the symptoms that were formerly thought to have no relation to the eyes. The means for relief is well known and consequently glass wearing is common. If we make the best possible use of what positive knowledge we now possess concerning the preservation of eyesight, the generations to come will enjoy more comfortable and efficient eyesight than any of the generations that have past.

CHAPTER V

THE SCHOOL INSPECTION

Outline and Record.—For the guidance of those who are not familiar with the symptoms of disease in the eyes and ears the outline found on page 24 has been prepared.

It is thought to be particularly well adapted to the use of teachers who are to carry out eye and ear inspections in public schools.

The inspector should first familiarize himself with the questions in the outline and gain as clear an idea as possible of their significance.

Very few of the questions will actually be put to the pupil. The teacher who is a keen observer will soon be able to record answers to prac-

Public School[s] of ———, Missouri

MEDICAL INSPECTION

Record of..... Date.....

School..... Grade..... Age..... Sex..... M.... F....

EYES. Evidences of eye disease or of refractive error.

Vision Right.....

Left.....

Color Vision.

EARS. Evidences of ear disease.

Hearing Right..... feet.

Left..... feet.

Acoumeter Voice. { Aloud. / Whisper.

NOSE AND THROAT

Card of warning to parents.

Eye Ear Nose Throat General

INSPECTOR

tically all the questions merely as the result of his observation of pupils in his charge.

Children are particularly susceptible to suggestion and it is important that they be allowed to tell their discomforts in their own way. Much direct questioning as to definite symptoms may lead the inspector into error and confusion.

The inspection outline should be used in connection with a suitable record blank. Such a blank form is shown on page 23. This form has been in use long enough to prove its usefulness. As will be seen, the form is divided into five general sections. The first is devoted to the general information for identification of the pupil. The eye section follows with a place for recording the state of vision, and, to the right of that, space in which any evidence of disease or eyestrain may be recorded. In the next section the printed form shows a place in which the state of hearing may be recorded in terms of feet at which the whispered or loud voice may be heard. It is intended that a check should be made opposite the word "whisper" or "aloud" to indicate which tone was used in making the test. If Politzer's acoumeter or the audiometer of McCollie are used, plenty of space is available for recording the findings. The right hand half of the section is intended for use in noting evidences of ear disease other than deafness.

The blank section for nose and throat findings has been found most satisfactory by the writer. Some inspectors prefer to have the names of the common nose and throat affections printed in the space and then check them as they are found at the inspection.

At the bottom the words under "Card of Warning to Parents" should be encircled to indicate the organ or organs on account of which a card of warning must be sent. The blank form from which the one here shown was copied was made exactly 6″ x 8″ so that when folded it could be easily filed with other school records that were 4″ x 6″ in size.

Inspection Outline for the Use of Teachers in Public Schools:

Section I.

A. Does the pupil have:—
   1. Stys?
   2. Red lid edges?
   3. Red eyeballs?
   4. Discharge from eyes?
   5. Excessive tearing?
   6. Bran like accumulations in the eye lashes?
   7. Crossed eyes?

B. Does the pupil:—
   1. Hold his reading matter close to the eyes, i. e., closer than fourteen inches?
   2. Have any difficulty in seeing clearly across a large room (twenty feet)?
   3. Hold his head in an unnatural position while reading?
   4. Dread the bright light of day?

C. Does the pupil complain of:—
   1. Headache or browache?
   2. Feeling of sand, itching or burning in eyes?
   3. Drowsiness?
   4. Blurring of print?
   5. Tired eyes after little reading?
   6. Any other symptom of eyestrain?

D. Does the pupil wear glasses?
   1. Are the glasses level before the eyes?
   2. Does each eye look through the center of the lens that is held before it?
   3. Are the glasses so placed on the nose that the pupil cannot see over them in looking at a distance?

E. What is the state of vision:
   (1). Without glasses?
   (2.) With glasses?

F. Does the pupil readily and accurately recognize and differentiate pure colors such as red and green?

Section II.
   1. Does the pupil have difficulty in hearing the ordinary whispered voice across a large room (twenty feet)?
   2. Is there any tenderness about the ears of which the pupil makes voluntary complaint?
   3. Does he have earache?
   4. Is there any evidence of discharge from, or ulceration of, the ear canal?
   5. Is there any offensive odor about the head, the source of which is not apparent?
   6. What is the state of hearing?

Section III.
   1. Does the pupil have the "snuffles"?
   2. Does he breathe through his mouth habitually?
   3. Is the voice abnormal in any way?
   4. Does he "take cold" easily?
   5. Does he have enlarged glands in the neck?
   6. Does he have sore throat often?
   7. Does he show any of the evidences of nasal obstruction?

Section IV.
   1. Is there dullness mentally that has no apparent cause?
   2. Does the pupil have difficulty in concentrating his attention upon his studies?

Types and Times of Inspections.—The regular routine physical examination of school children should be required by law. Twenty states have made school inspections possible by legislative enactment. While all states should have laws covering this matter it is obvious that lack of state law need not necessarily prevent any school community from establishing that scheme of inspection best suited for its purposes.

The ideal organization for medical inspections is that in use in certain of the larger cities of this country. Physicians with training that especially fits them for the work are employed to make daily inspections of a limited number of children. Such a plan makes it possible promptly to exclude children who suffer from communicable diseases. The physical abnormalities that handicap a child in his school work are also discovered early and called to the attention of parents. A very good modification of this plan is that by which the daily inspections are made by nurses whose work is supervised and augmented by physicians at frequent intervals. There should be one school nurse for every 1000 of the school enrollment.

Both of the plans mentioned above contemplate the complete inspection of the school child. The problem discussed in this bulletin concerns particularly the inspection of the organs of sight and hearing and the work of such inspection does not necessarily require more knowledge for its successful accomplishment than is herein set forth. In some communities an arrangement is made by which a local physician makes an annual inspection. The value of such a plan depends upon the intelligence and thoroughness with which the inspection is carried out. Naturally much depends upon the discrimination of School Boards in the selection of inspectors. The opportunity for error is so great that the plan is mentioned here simply to condemn it.

When the services of a competent physician are not available the usually already overworked teacher must make the inspection. Fortunately, the eyes and ears of pupils may be investigated by the average teacher without any previous experience with such matters, if some inspection outline similar to the one here suggested is adopted. Such investigations will elicit much valuable information and result in untold good to pupils, if the cards of warning can be made to bring forth the reaction in parents that they are intended to stimulate.

It is very easy to calculate that every teacher can make the sum total of his teaching task much easier provided he makes proper use of the information gained by any good routine inspection of the eyes and ears. The child who has less than normal eyesight or hearing will inevitably require much individual attention from the teacher, more attention by far in point of time expended than could possibly be used in a routine inspection of eyes and ears. It is plain that a child with lessened hearing in such degree as to interfere with plain and distinct articulation will absorb more than his fair quota of the teacher's time and energy and will therefore lower in some degree the quality of the class room work of that teacher. Multiply the one example by the amount of ten per cent or fifteen per cent of the whole class and the extra burden borne by the teacher is seen to be enormously in excess of that created by the obligation to make a few routine inspections a year. Each inspection develops its quota of pupils needing medical attention. With that attention forthcoming, the amount of extraordinary teaching effort is lessened and the efforts expended in inspections are justified. All this of course takes no account

of the invaluable benefits that accrue to pupils by reason of the early correction and indeed cure of small defects which, if allowed to persist, might forever lessen the child's usefulness. The problem is plainly and simply one in preventive medicine and the circumstances as they exist justify all the attention of physicians, schoolboards, and teachers that can possibly be centered on them.

It appears that the teacher in carrying out medical, or better, physical examinations would better confine his attention chiefly to the conditions of the eyes and ears, as to detailed investigation, and let the rest of his general survey take account only of the gross general conditions that are obviously effective in limiting the child's ability to profit by his residence in school. If a child is in need of the services of a dentist that should be noted and reported. The teacher should avoid the error of attempting to go so far into inspection work as to make diagnoses of conditions. The suggestion to parents that there is eye or throat or ear trouble that is hindering a child's progress in school is usually sufficient. Any teacher can give correct information to parents as to the desirability of having immediate medical attention for a pupil who is an habitual mouth breather. The card of warning will accomplish that much and the physician will give advice as to the measures necessary to insure against a continuance of mouth breathing.

The outline here presented for the use of teachers purposely omits any lead which would involve the inspector in problems that would be difficult either as to the formation of proper judgments, or the execution of the technic of inspection.

Eye and ear inspection should be made: at the beginning of the school term; after the first six or eight weeks of school; as often thereafter as is reasonably possible in consideration of the demands upon the teacher's time.

The inspection at the beginning of the school year gives information as to the existence of visual or aural defects and handicaps presumably previously unnoticed. The second inspection, after the lapse of six or eight weeks, gives opportunity to determine what deleterious effects, if any, have resulted from the educational process in pupils found to be normal at the first inspection. It also allows a check on the parents to whom cards of warning were sent as a result of the finding of the first inspection. Inspections should be systematic and the record of them should be exact, uniform, permanent, and as free as possible from confusing technical terms.

The inspections should be carried on in a well lighted room having one dimension at least of twenty feet in the clear. The room must be so lighted as to make possible good illumination of a test chart of letters. The room must be quiet and isolated so that one pupil may be examined at a time. The examiner should have an assistant, if possible, to inscribe the findings as they are determined by the examiner. The findings should be recorded upon individual blanks provided for the purpose.

The Technic of Inspection.—It should be understood that the primary purpose of such an inspection as is herein described is to call attention to every single eye, ear, or throat factor that is capable of preventing a child from getting the maximum of good from his school work and to advise its correction. A secondary but at the same time important purpose is to exclude from the school room any pupil whose presence there is in any sense a menace to his fellow pupils.

The examination of the eyes should be undertaken with two aims in mind. First, to determine whether or not a child suffers from inflammatory or communicable diseases of the eyelids, and second, to record the state of vision and make note of any evidences of the existence of eyestrain.

Diffuse daylight free from the direct rays of the sun furnishes proper illumination for the investigation as to inflammatory lid troubles. While no examination can be complete without eversion of the lids, such a procedure is not to be attempted by the teacher. Sufficient information for the safety and well being of all pupils can be obtained by merely looking at the eyes without touching the face of the pupil.

Certain communicable diseases of the lids, of which pink-eye is the most common, are found among school children. Fortunately they all have some symptoms in common by which they may be recognized by any person who will use some care in making the observations. Redness of the eyes, excessive tearing, stringy or creamy discharge, and dread of light are common to all the acute lid infections. The existence of such symptoms is strong enough presumptive evidence to cause the teacher to exclude from school any pupil who exhibits them.

Facts that have been recently gathered tend to show that the disease trachoma or true granulated lids is generally prevalent in Missouri. This disease is very apt to destroy vision entirely, it is hard to cure, and may resist treatment for years. It exists in two general types, active and inactive. The later type is usually only a latent stage of the disease and it may become active at any time. In the active stage the disease is easily communicated by the discharges, it is even conditionally contagious in the inactive stage. The symptoms previously mentioned are usually found in the contagious state of the disease.

Trachoma is always a menace to the sight of its possessor and a constant danger to those who live in its presence. The disease should be continually treated until it is cured. No confusion should exist because of the unfortunate promiscuous use of the words granulated lids in connection with certain eye conditions not trachomatous. The linings of the lids may look rough and granular and yet be free from real trachoma. Moreover the accumulation on the edges of the lids of granular masses, referred to elsewhere as branlike scales, should not be called granulations. Such a condition is in no sense an indication of trachoma. Unfortunately some physicians are careless about the use of the term granulated lids, and the term should be used only in referring to trachoma. In matters of school hygiene no carelessness should be tolerated in naming inflamma-

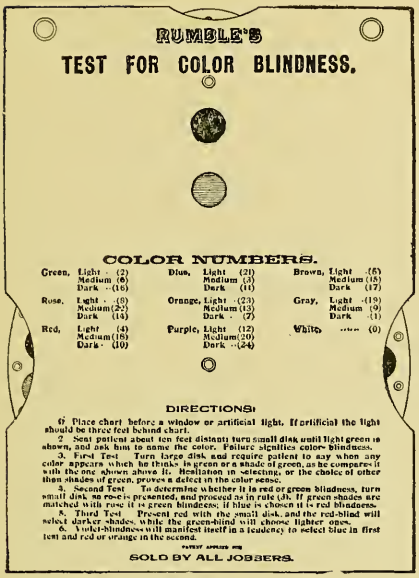

FIG. 5

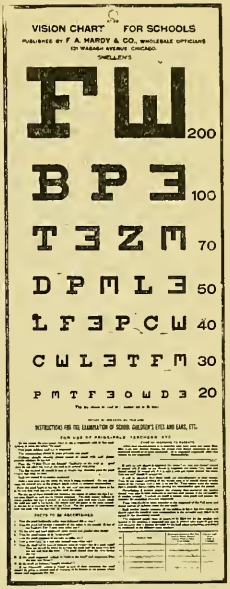

FIG. 6

FIG. 7

FIG. 8

Types of Test Charts for the Eyes. (ACknowledgment is due to the F. A. Hardy Company of Chicago for their kindness in furnishing the plates from which these reproductions were made.)

tory lid conditions. Many times the determination of the existence of trachoma is difficult and can be made only by an expert in diseases of the eyes.

Following exclusion from school on account of redness, tearing, or discharge from the eyes, return should be permitted only on presentation of a physician's certificate that no communicable disease exists.

Next in order should come the record of the seeing power or state of vision. This is best determined by means of the Snellen Test Chart or some of its modifications. It should be noted that Test Charts should be hidden from view except during tests, lest pupils familiarize themselves with the letters and thus consciously or unconsciously deceive the examiner. To the end that no memorizing of the charts may occur during the tests it is well to have an assortment of charts.

Figure 6 shows the Allport modification of the Snellen Chart. This chart is especially useful for school inspections for the reason that each chart has attached to it full directions for its use and also useful information concerning the making of records and cards of warning. The chart shown in Figure 7 has the advantage of combining test letters with a test of color vision. Underneath the line of letters marked 6 is a heavy solid green line, and under the line marked 8 is a solid red line. The inspector asks the pupil to read the letters above the red line or below the green line and in that way proves his ability to recognize colors as well as the letters.

Figure 8 shows a chart for the use of illiterates. The child in the first grade may not be familiar with the alphabet. He can call the names of the objects in the lines and thereby make possible a record of the state of vision. Accurate recording of the state of vision of first grade pupils is difficult.

Test charts should be made of heavy card board and should be free from gloss. In all charts one line is designated as the standard or normal line. It should be seen by a single unaided eye at a distance of twenty feet when tested under the conditions mentioned below. At the end of the normal line in Figure 6 will be seen the figure 20 which indicates that the line should be seen by the normal eye at twenty feet. All the other lines are marked in the same terms. The so-called normal or standard line may or may not be the bottom line on the test card. However that may be, the lines above the normal line are so constructed as to be seen at increasing distances. If any lines of letters appear on the chart below the normal line they are intended to be seen by the standard eye at a distance of less than twenty feet.

The recording of the state of vision is accomplished then as follows:

The test chart must hang in good daylight, twenty feet away from the pupil, with the normal line of letters on a level slightly below that of the child's eyes as he stands or sits while under test. The source of light must be behind and to the side of the pupil and never in a place to allow direct or troublesome cross lights to enter the eyes under test. Direct sunlight must be excluded from the region in which the test chart hangs.

Children who ordinarily wear glasses should have a record of vision first without glasses and then with glasses. One eye is lightly covered, and never pressed upon, by a card of sufficient size to exclude effectually all use of the eye under cover and at the same time to throw no shade over the eye under test. In covering one eye and then the other for the purpose of testing and recording the state of vision, it is well for the examiner to observe a fixed custom of always testing first either the right or left eye,—it matters not which one so long as the practice is uniform with all pupils. With one eye covered as indicated, the pupil is asked to read the chart from the top down, saying clearly the letters as he sees them in each line. The pupil should be cautioned to read carefully and slowly if he shows any tendency toward inaccuracy. It often happens that the pupil will cease reading before the normal line is reached, in which case he should be encouraged to "try the next line", and the next and the next and so on until the examiner is positive that the pupil has actually read the smallest line that he possibly can. The record should show the smallest line that can be read by any possibility, not the one that can be easily seen.

If it so happens that the pupil reads the normal or standard line with the right eye, for example, the record should show that the vision in the right eye equals 20 / 20 which simply means that the right eye sees at a distance of twenty feet the line that a normal eye should see at that distance. The vision then is normal. If by chance the eye under test sees a line smaller than the standard, the examiner will note the number at the end of the line. If the line happens to be the one that should be read at fifteen feet, then the state of vision is recorded as 20 / 15 which means that the eye under test sees at twenty feet that line which the standard eye should see at fifteen feet. In other words the record of the state of vision is made in the form of a fraction the numerator of which always indicates the number of feet between the test chart and the eye under test. The denominator of the recording fraction indicates the distance in feet at which the normal eye should see the line of letters which has been found to be the smallest possible one that can be read by the eye under test.

For example, if the eye under test sees only the line of large letters at the top of a chart and the normal eye should see that line at two hundred feet, the record would show the vision in the eye under test to be 20 / 200. The recording of the state of vision in the form of fractions is used merely as a convenience and is an almost universal practice among oculists. Sometimes this record is made in terms of meters instead of feet. It should not be assumed that the fractions recorded are reducible in computing the quantity of vision and that the record 20 / 200 vision, for instance, means that an eye so recorded has 1 / 10 the power of the normal eye. In case the pupil reads the normal line correctly except one or two letters, the vision may be recorded as 20 / 20 minus. If on the other hand, he reads the normal line or any other line, and a few letters in the one below it, the record may be made to show that by adding the plus sign after the recording fraction.

In determining the state of vision for the second eye the procedure should be the same as for the first one. Teachers are advised against the use of the astigmatic charts or dials in school inspections. No really useful information will be gained and much time will be wasted in efforts to use them. Due consideration should be given to all the suggestions in the inspection outline. When the abnormal conditions there suggested are found to be present, they should be noted in the proper place on the inspection record.

In answering the question "F" in Section I of the Inspection Outline the purpose is to determine the presence or absence of color blindness. One of the simplest means of settling the question as to color blindness is to make use of the Rumble Test, apparatus for the making of which is shown in Figure 5. The colors are shown by transmitted light and the card is so arranged as to discourage subjectivity or simulation on the part of the pupil. Full directions for its use accompany each chart.

No conclusions as to the nature of the eye defect should be attempted merely as a result of the finding of the state of vision. The vision of one child may be 20 / 20 or even 20 / 13 in the presence of violent symptoms of eyestrain due to farsightedness. The identical kind and degree of error in another child may reduce the vision to 20 / 30 or even more without producing a single painful symptom.

There is very little in the mere appearance of eyes to lead one to a correct determination of their refractive condition. Eyes that cross inward or toward the nose are usually farsighted. Those that cross outward or toward the temples, are usually nearsighted. In crossed eyes, the myopia or hyperopia is usually not equal in the two eyes. Persons who squint are usually nearsighted. Those who hold reading close to the eyes are usually nearsighted, but they may be highly farsighted. In high farsightedness, nearsightedness, and astigmatism, the distance seeing power is lowered in direct proportion to the amount of refractive error.

The possession of good sight is by no means an evidence of normal eyes. There is nothing about a moderate degree of farsightedness to preclude the possession of most acute vision for distance seeing. Many an individual "sees well" who suffers intense eyestrain. Forty per cent of people who need and wear glasses for relief of eyestrain can see normally in the distance without glasses. They make use of glasses not that they may "see better" but that they may see in comfort, i. e. without the development of eyestrain.

Glasses do not cure refractive errors in the sense of causing them to disappear or grow less in degree. Properly fitting glasses do cause the symptoms of eyestrain to disappear and they do also tend to check the progress of nearsightedness.

It should be the universal practice to send a card of warning in the case of children with less than normal vision in one or both eyes whether symptoms of eyestrain are present or not. With the evidence of eye-

strain at hand, the card of warning must be sent whether the vision is normal or not.

The eye condition having been investigated one next proceeds to the inspection of the ears.

Tests of hearing are carried out more or less roughly in inspections by teachers. The results are very satisfactory if proper heed be taken of any indications of faulty function. For purposes of inspection of the ears by teachers, the human voice may best be used as the test sound. The ordinary speaking voice of the examiner as produced after an ordinary expiration, i. e. when only the residual air remains in the lungs, is a good and fairly constant test tone. Under the condition of testing here presumed, it is sufficient that the record state whether the pupil can or cannot hear whispered words, numbers, and short sentences with a single ear across a large, quiet schoolroom. The normal ear hears whispered speech at a distance of fifty feet in a still room.

During the test the pupil should stand facing away from the examiner and should have one finger pressed tightly into the ear not under test. In this position he should repeat after the examiner the words, numbers, or phrases spoken by the examiner. It is very important that the child shall not see the movement of the inspector's lips during ear tests.

The loss of a noticeable amount of hearing is not proof positive of serious ear disease, but in this instance as well as others here considered, prompt and efficient attention during early school life may overcome the beginnings of what might develop into a serious obstacle to progress in school and business.

Small degrees of deafness are sometimes serious to children. The hearing is a great aid in the development of fluent and accurate speaking in the sense of ordinary conversation and the loss of acute hearing handicaps the young pupil in proportion to the degree of deafness. Any discharge from the ear canal, be it scanty or profuse, demands the immediate attention of an aurist or family physician. The presence of ear discharge may be discovered in searching for the source of an unpleasant odor coming from the person of a pupil. Most foul smelling ear discharges indicate the existence of serious ear disease.

The card of warning will be forthcoming of course in case affirmative reply can be made to any one of the first four questions in Section II of the Outline. If the hearing is lowered that fact must surely be reported in a card of warning.

Concerning the condition of the nose and throat, no information need be recorded by the teacher except that elicited by attention to the questions under the heading Section III in the Outline. Intelligent replies to the seven questions will in the majority of cases give sufficient evidence to warrant the card of warning if it should be sent at all. It is not to be expected that the teacher shall give an opinion as to the normal or diseased condition of a throat as the result of its direct inspection. Such

determinations are plainly the duty of the physician or other specially trained person.

From the standpoint of the teacher the paramount factor in the inspection of the nose and throat is to determine if possible whether there exists in these regions enlarged, obstructive, or diseased adenoid tissue. Attention to the questions in the Outline will help greatly in the determination.

The Card of Warning.—The wording of the card of warning will vary with the type of inspection that has been conducted.

For the school superintendent it is sufficient in addressing a parent to say that the school inspection shows some apparent eye, ear, or throat trouble, as the case may be, and further that he, the parent, is urged to have immediate council with the family doctor, the oculist, or the aurist as the needs indicate. It is useless to insist upon the council with an oculist in a small community where no such specialist resides. Here the pupil must be referred to the family doctor and he must determine whether the pupil can be cured at his hands or must seek an oculist or aurist. Care must be used to the end that the ignorant layman may be helped as much as possible to differentiate good from unworthy physicians. Too much confusion exists in many quarters concerning the terms oculist and optician. The card of warning should not confuse those terms.

A child who refuses the regular inspection and declines to submit to it ought to be excluded from the benefits of the public schoolroom until he will submit. With the very young, the tests can be carried on much as if they were games.

REFERENCES FOR FURTHER READING

Allen, William H.,	Civics and Health.
Coler, George W.,	Teeth, Tonsils and Adenoids. Note: This little booklet can be secured free of charge upon application to the Home Office of the Metropolitan Life Insurance Company, 1 Madison Ave., New York City.
Cornell, Walter S.,	Health and Medical Inspection of School Children.
Gould, George M.,	Biographic Clinics, Vols. 1 to 5.
Norris and Oliver,	System of Diseases of the Eye, Vol. 2.
Reick, Henry O.,	Safeguarding the Special Senses.

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The University of Missouri has established, in connection with the Department of Preventive Medicine, a bureau of information. This office will upon request furnish to the citizens of Missouri practical information regarding the prevention of disease. A laboratory is also provided to make the necessary examinations. The service of the bureau and, as far as practicable, those of the laboratory are free of charge. For further information, address Preventive Medicine, University of Missouri, Columbia, Mo.

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